

We Claim:

1. A data transfer device adapted to transfer data from a data storage
medium having at least one data storage element, the data transfer
device comprising:
a head block having first and second transfer elements;
the first and second transfer elements arranged such that, when, in
use, the data storage medium moves past the first and second
transfer elements said at least one data storage element is aligned
with both of said first and second data transfer elements; and
wherein the first data transfer element is arranged to read data
from a portion of said at least one data storage element at a
different time to the second data transfer element being arranged to
read data from said portion of said at least one data storage
element.
2. A data transfer device according to Claim 1 wherein the data
storage medium is a magnetic tape.
3. A data transfer device according to Claim 2 wherein the data
storage element is a track on the tape.
4. A data transfer device according to Claim 1 wherein the head block
is in a fixed position.
5. A data transfer device according to Claim 1 wherein the medium
is arranged to be rewound to enable the second transfer element to
read said data from said portion of said at least one data storage
element.

6. A data transfer device according to Claim 1 wherein the second transfer element is arranged to read data from said portion of the at least one data storage element if the first transfer element has failed to read data from said portion.

7. A data transfer device according to Claim 1 wherein the device includes a control unit with which the transfer elements are adapted to communicate, said control unit being adapted to determine whether said first transfer element has failed to read said data from said portion.

8. A data transfer device according to Claim 7 wherein the control unit includes a comparator arranged to execute at least one of the following error detection techniques upon the data read by said first data transfer element:

- i) cyclic redundancy checks
- ii) parity checks
- iii) non-correctable error detection codes
- iv) non-expandable data decompression codes

9. A data transfer device according to Claim 8 wherein the second transfer element is arranged to read data from said portion of the at least one data storage element if the data read by the first transfer element fails any one of the error detection techniques of Claim 8.

10. A data transfer device according to Claim 1 wherein the data storage medium is any one of the following:

- i) a magneto-optical disc
- ii) a magnetic disc
- iii) a C.D.
- iv) a mini-disc.

11. A data transfer device according to Claim 1 wherein the device is any one of the following:

- i) a linear tape drive
- 5 ii) a helical tape drive
- iii) a magnetic disc drive,
- iv) a C.D. drive
- v) a mini-disc drive.

10 12. A data transfer device adapted to transfer data from a data storage medium having data storage elements;

the data transfer device comprising:

a displacement element having a first condition and a second condition;

15 first and second transfer zones being adjacent the first and second transfer elements respectively when said displacement element is in said first condition;

and wherein the first transfer zone is arranged such that, when in use with the displacement element in said first condition, the data
20 storage medium moves past the first and second transfer elements with first and second data storage elements aligned with said first and second transfer elements respectively; and

the displacement element being arranged to be moveable to said second condition in which, in use, relative displacement between at least a said transfer element and said transfer zones occurs such
25 that a transfer zone that is aligned with one of said transfer elements when said displacement element is in said first condition is aligned with the other of said transfer elements, thereby enabling a said transfer zone to be alignable selectively with said first and
30 said second data transfer elements at different times.

13. A data transfer device according to Claim 12 wherein the data storage medium is a magnetic tape.

14. A data transfer device according to Claim 12 wherein the data storage element may be a track which may be on the tape.

15. A data transfer device according to Claim 12 wherein the medium is arranged to be rewound such that one of said data transfer elements that was passed either of the first or second transfer zones in the first condition passes the other of the second or first transfer zones in the second condition.

16. A data transfer device according to Claim 12 wherein said displacement element is adapted to displace the transfer elements relative to the data storage medium.

17. A data transfer device according to Claim 12 wherein said displacement element is adapted to displace said transfer elements relative to the storage medium in a direction that is transverse to a direction of passage of the storage medium past the transfer elements, in use.

18. A data transfer device according to Claim 12 wherein the device includes a control unit and the transfer elements are arranged to communicate with the control unit, said control unit being adapted to determine whether said first transfer element has failed to read data from said portion

19. A data transfer device according to Claim 18 wherein the control unit are a plurality of buffers and each buffer is adapted to store,

temporarily, data communicated between the storage element and at least one of the transfer elements.

20. A data transfer device according to Claim 19 wherein control unit
5 includes a comparator which is adapted to compare a data element indicative of the data transferred from the data storage element by the at least one transfer element to a data element of the data stored in the each buffer associated with the at least one transfer element, in use.

- 10 21. A data transfer device according to Claim 12 wherein the data storage medium is selected from the following list:

- i) a magneto-optical disc
ii) a magnetic disc
15 iii) a re-writeable C.D.
iv) a C.D.
v) a mini-disc

- 20 22. A data transfer device according to Claim 12 wherein the data transfer device is selected from the following list:

- i) a linear tape drive
ii) a helical tape drive
iii) a magnetic disc drive
iv) a C.D. drive
25 v) a mini-disc drive

23. A data transfer device having a data storage medium comprising:
a head block having first and second transfer elements;
both the first and second transfer elements being aligned with a
30 data storage element of said data storage medium; and

wherein the first data transfer element is arranged to read data from a portion of said at least one data storage element at a different time to that at which the second data transfer element is arranged to read data from said portion of said at least one data storage element.

24. A data transfer device according to Claim 23 wherein the second transfer element is arranged to read data from said portion of the at least one data storage element if the first transfer element has failed to read data from said portion.

25. A data transfer device according to Claim 23 wherein the device includes a control unit with which the transfer elements are adapted to communicate.

26. A data transfer device according to Claim 25 wherein the control unit includes a comparator arranged to execute at least one of the following error detection techniques upon the data read by said first data transfer element:

- i) cyclic redundancy check
- ii) parity check
- iii) non-correctable error detection code
- iv) non-expandable data decompression code

27. A data transfer device according to Claim 26 wherein the second transfer element is arranged to read data from said portion of the at least one data storage element if the data read by the first transfer element fails any one of the error detection techniques of Claim 26.

28. A data transfer device according to Claim 23 wherein the data storage medium is any one of the following:

- i) a magnetic tape
- ii) a magneto-optical disc
- iii) a magnetic disc
- iv) a C.D.
- v) a mini-disc.

29. A data transfer device according to Claim 23 wherein the device is any one of the following:

- i) a linear tape drive
- ii) a helical tape drive
- iii) a magnetic disc drive,
- iv) a C.D. drive
- v) a mini-disc drive.

30. A data transfer device having a data storage medium, a head block having first and second transfer elements; a displacement element; the first transfer element arranged to transfer data between the head block and a data storage element of the data storage medium; the displacement element being actuatable to achieve relative displacement between the head block and the data storage medium such that following displacement the second transfer element is arranged to transfer data between the head block and the data storage element.

31. A data transfer device according to Claim 30 wherein the displacement element is adapted to displace the head block relative to the data storage medium in response to the instruction, in use.

32. A data transfer device according to Claim 30 wherein the displacement element is adapted to displace the head block relative

to the storage medium in a direction that is transverse to a direction of passage of the storage medium past the transfer elements, in use.

- 5 33. A data transfer device according to Claim 30 wherein the displacement element is adapted to move the storage medium past the head block.
- 10 34. A data transfer device according to Claim 30 wherein tape is adapted to rewind tape to bring a data storage element back up for second element, tape having gone under it before to get the first element.
- 15 35. A data transfer device according to Claim 30 wherein the device includes a control unit and wherein the transfer elements are adapted to communicate with the control unit, in use.
- 20 36. A data transfer device according to Claim 30 wherein the control unit includes a comparator adapted to compare a data element indicative of the data transferred from the data storage element by the at least one transfer element to a second data element.
- 25 37. A data transfer device according to Claim 30 wherein the transfer elements are of a type selected from the following list:
- (i) write heads
 - (ii) read heads
 - (iii) combination of both read and write heads
 - (iv) a combined read-write head.
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38. A data transfer device according to Claim 30 wherein the data storage medium is selected from the following list:

- (i) a magnetic tape
- (ii) a magneto-optical disc
- (iii) a magnetic disc
- (iv) a re-writeable C.D.
- (v) a mini-disc

39. A data transfer device according to 30 wherein the data transfer device is selected from the following list:

- (i) a tape drive
- (ii) a magnetic disc drive
- (iii) a C.D. drive
- (iv) a mini-disc drive

40. A method of reading data from a data storage medium comprising the steps of:

- (i) providing a plurality of data transfer elements;
- (ii) reading said data from a data storage element of the storage medium via a first data transfer element;
- (iii) error checking a data element indicative of the data read from the storage medium via the first data transfer element; and
- (iv) reading said data from said data storage medium via a second transfer element if the comparison of step iii) results in an error signal.

41. A method of reading data according to Claim 40 comprising aligning the second transfer element with both the first transfer element and the data storage element and having the plurality of data transfer elements in a fixed position.

42. A method of reading data according to Claim 40 comprising actuating a displacement element so as to effect a relative displacement of the storage medium and the plurality of data transfer elements.

43. A method of reading data according to Claim 42 comprising the displacement element acting upon the data transfer elements.

44. A method of reading data according to Claim 42 comprising the displacement element acting upon the data storage medium.

45. A method of reading data according to Claim 40 comprising executing of a cyclic redundancy check upon said data elements.

46. A method of reading data according to Claim 40 comprising executing steps ii) and iii) up to a pre-determined number of times prior to executing step iv) if the initial repetition of steps ii) and iii) does not avoid the production of an error signal.

47. A method of reading data according to Claim 46 not executing step iv) if any one of the comparisons results in a match.

48. A method of reading data according to Claim 40 comprising reporting a read error to a user of the storage medium if steps i) to iv) of the method are repeated more than a pre-determined number of times during a single read operation.

49. A method of reading data according to Claim 40 comprising providing the data storage medium in a form selected from the following list:

- 5 (i) a magnetic tape
- (ii) a magneto-optical disc
- (iii) a magnetic disc
- (iv) a C.D.
- 10 (v) a mini-disc

50. A data transfer tape device adapted to transfer data to a data storage tape having a data storage track;

the data transfer device comprising:

first and second data transfer elements;

15 a displacement element;

a control unit including a comparator;

the data transfer elements being arranged such that, when, in use, the data storage tape is moving past the transfer elements the data storage track is aligned therewith;

20 the comparator being arranged to error check data written to the data storage medium; and

the displacement element being arranged to achieve, in use, relative transverse displacement between said transfer elements and transfer zones such that either the first or the second transfer elements is selectively alignable with the data track, in use, in response to the instruction from the control unit.

51. A machine readable data carrier having encoded upon it instructions to control a control processor of a data transfer device having first and second read/write data transfer heads, a data recording medium having a read/write zone adjacent the heads, a

multi-channel recording medium provided in the zone adjacent the heads, and a head to channel alignment device adapted to control the relative position, transverse to the direction of movement of the medium past the heads, of the heads and the channels of the medium, the instructions causing the control processor to read or write data to or from a channel on the recording medium and to check the read or written data for errors, and upon detecting an error the instructions causing the control processor to control the alignment device to align the channel which caused the error signal with a different head to that which was used in the read/write operation which resulted in an error signal.

52. A method of reading data from a data carrier using a device with first and second data transfer heads arranged in a read-after-write configuration with both heads aligned with a common data track comprising attempting to read the data from the data carrier using the first head and subsequently reading the data using the second head.

53. A method as claimed in Claim 52 wherein the second head is used to read the data if the first head has difficulty reading it.

54. A method as claimed in Claim 52 wherein the second head is a write head capable of writing data to the carrier as well as reading data from the data carrier.

55. A method as claimed in Claim 52 wherein the method comprises determining that the first head has not read data of a region of the data carrier properly and advancing or rewinding said region to align it with the second head.

56. A method as claimed in Claim 52 wherein the data carrier comprises a tape which moves past the second head before it encounters the first head and the tape is rewound in order to read a section of the tape with the second head.

5 57. A data transfer device arranged to read data from a data carrier comprising data transfer heads arranged in a read-after-write configuration having both heads arranged to be aligned with a common data track of the data carrier, the first head arranged to read data from the data carrier and the second head subsequently arranged to read data from the data carrier.

10 58. A device according to Claim 57 wherein the second head is arranged to read the data if the first head has difficulty reading it.

15 59. A device according to Claim 57 wherein the second head is a write head arranged to be capable of both reading and writing data carrier.

20 60. A device according to Claim 57 wherein the device is arranged to determine that the first head has not read data of a region of the data carrier properly and advancing, or rewinding said region to align it with the second head.

25 61. A device according to Claim 57 wherein the data carrier is a tape which is arranged to move past the second head prior to encountering the first head and the tape is rewound in order to read a section of the tape with the second head.